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Truth, trust, and civic duty: Cultural factors in citizens' perceptions of mobile phone apps and social media in disasters

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Abstract

This study investigates how citizens perceive the role of mobile phone apps specifically designed for disaster communication, and how these perceptions may differ from perceived roles and functions of social media in disaster-related tasks/situations. Focusing on trust in authorities and technology use, results suggest that social media use not only fosters trust via shared narratives and collective sense-making but may also improve trust relationships through local authorities assuming the function of a trustworthy information provider. In disaster apps usage, trust between citizens and authorities is generated through perceptions of shared responsibility rather than shared narratives. Apps were seen as mechanisms that reveal authorities' general willingness to share control, which may help overcome citizens' perceptions that they are distrusted by authorities.

KEYWORDS

citizen summits, culture, disaster communications, mobile phone apps, social media, trust

1 | INTRODUCTION

Increased adoption of social media in crisis situations started about 15 years ago, and in particular, the last decade has seen immense interest and an increasing number of studies on the actual and potential uses of social media for disaster preparedness, response, and recovery (Alexander, 2013; Reuter & Kaufhold, 2018). Early research focused on citizens' use of photograph repository sites for information exchange, such as during the 2004 Indian Ocean Earthquake and Tsunami or the 2007 southern California wildfires (Liu, Palen, & Sutton, 2008; Shklovski, Plen, & Sutton, 2008; Sutton, Palen, & Shklovski, 2008). Reports on one of the most recent uses of social media and messaging apps—the warning of air strikes via Facebook and instant messaging apps sent to civilians and “White Helmets” civil defence workers in Syria's rebel-held territories¹—highlight the life-saving role of social media and messaging apps in humanitarian disasters (Ensor, 2018). With 2.27 billion monthly active Facebook users and 336 million monthly active Tweepers worldwide in 2018,²

a large number of studies have specifically focused on the roles and usage patterns of these two types of social media in times of crisis, such as the spread of tweets in response to the November 2015 terrorist attacks in Paris (Cvetojevic & Hochmair, 2018).

Social media play a role in a wide variety of disasters, and their usefulness has been identified and assessed for different disaster phases. In the preparedness phase, social media have been found to be effective tools for increasing self-confidence, motivation to practise, and enabling the memorizing of appropriate behaviour, making the effort of learning about preparedness measures more appealing and, when used in combination with virtual reality, more fun (Chen, Shih, & Yu, 2012; Winami & Purawandari, 2018). During the acute phase of a disaster, when intensified information-seeking is a coping mechanism with the stressful situation, social media can reduce citizens' feelings of uncertainty and isolation, enhance collaborative problem-solving, and foster citizens' ability to “make sense” of the event, as they do not only provide the basis for new understandings but also for new behavioural norms (Jurgens &

Helsloot, 2018; Neubaum, Rösner, Rosenthal-von der Pütten, & Krämer, 2014; Tierney, 2009; Zhang, 2013). In the recovery phase, social media have been found to be the most extensively used platform for bi-directional communication between citizens and the authorities (e.g., Tagliacozzo & Magni, 2016). Social media provide at this stage a way to satisfy the need to take action, which allows disaster victims to (re-)gain a feeling of control (Spence, Lachlan, Xialing, & Greco, 2015) and enabling them to, at least “virtually,” return home (Hughes, Palen, Sutton, Liu, & Vieweg, 2008). However, in their functional framework for social media use in disaster planning, response, and research, which identified 15 distinct disaster-related social media uses, Houston and colleagues demonstrated that many of these uses are likely to overlap across different disaster phases, for example, in the function of fostering community cohesion (Houston et al., 2014).

Furthermore, studies have identified different types of crisis communication via social media: citizen-to-citizen; authorities-to-citizen; and citizen-to-authorities communication. Research (Starbird & Palen, 2011) into citizen-to-citizen communication on social media, that is, the sharing of information, organizing of self-help, and providing emotional support, has described the emergence of “digital volunteers” during the 2010 Haiti earthquake. These findings are supported by longitudinal studies, which showed that social media use is, generally, related to an increase in cognitive and affective empathy over time (e.g., Vossen & Valkenburg, 2016). Research into authorities-to-citizen communication, that is, alerting the general public about disaster risks and providing information about appropriate behaviour in the acute disaster situation as well as advice during the recovery phase, has found increasing usage of social media by disaster management authorities, but also identified shortcomings such as lack of expertise and lack of practical guidance (Plotnick & Hiltz, 2016). Research into citizen-to-authorities communication, that is, communication for integrating citizen-generated content in disaster management, has highlighted the immense potential of crowdsourcing, such as the PetaJakarta project, which is mapping Twitter data for flood mitigation (Holderness & Turpin, 2017), but also issues of disaster managers' mistrust of user-generated social media data (Mehta, Bruns, & Newton, 2017). Other studies in this area have conceptualized the use of citizens' activities on social media as “social sensors.” By monitoring the activity of eyewitnesses on social media and mobile phones traffic, an intensification can indicate that a disaster has occurred, thus enabling the fast detection of disasters such as earthquakes (Bossu et al., 2018). Further research, for example, into the behaviour of social media users during and after the Great East Japan Earthquake of 2011, has revealed not only the importance of multi-level functionalities, that is, citizen-to-citizen, authority-to-citizen, citizen-to-authority communication, but also the value of linking these different levels of communication (Jung & Moro, 2014).

The accelerated development of “disaster apps” in recent years may be seen as an attempt to address the need for multi-level, multi-function, disaster communications beyond social media. For

the purpose of this study, “disaster apps” are defined as mobile phone apps, which are specifically designed for the purpose of disaster-related information and communication (such as NINA or KATWARN in Germany), in contrast to apps that are not designed for this purpose but are used in case of emergency (e.g., the traffic and navigation app Waze, or the app versions of social media websites). Whereas the early years of app development saw a strong emphasis on authority-centric one-way communication, which limited the public to the role of victims or passive information receivers, more recently there has been a paradigm shift towards seeing citizens also as participants who can provide information via apps to authorities as well as provide aid themselves (Tan et al., 2017). These mobile phone disaster applications are designed to support complex connections between multiple stakeholders, can send alerts and disaster-related information to citizens, provide recommendations and guidance for citizens on disaster preparedness, allow citizens to submit information to authorities or collect information from citizens, and/or provide a platform for information-sharing between citizens, often via links to social media platforms.³

Although such mobile phone apps have been found to generally foster disaster resilience in citizens (Aydin, Tarhan, Selcuk, & Tecim, 2016; Bachmann, Jamison, Martin, Delgado, & Kman, 2015; Horstmann, Winter, Rösner, & Krämer, 2018; Karl, Rother, & Nestler, 2015), research has also found barriers to citizens' engagement with crisis alert systems (e.g., Madden, 2015). There is still little research on how citizens view these apps, and how perceptions of disaster apps may differ from perceptions of social media. A recent review of the literature on mobile communication in crisis informatics identified this gap⁴ in the literature and highlighted the need for further research: “To fully realise the potential of mobile apps for disasters, it is important that future research engages in citizen-centred studies to gain more insight into users' needs, motivations, expectations, experiences, and limitations when using disaster apps” (Tan et al., 2017, p305).

This exploratory study targets the gap from a socio-cultural anthropology perspective, by investigating not only the functional uses (see Houston et al., 2014, for social media), but also the relationships between citizens' perceptions of both disaster apps and social media. It will do so with a specific focus on the role of citizens' trust in authorities, because such trust has been found to be an important driver in the uptake of information tools developed by these authorities (e.g., Tagliacozzo & Magni, 2016). At the same time, it will employ a “dual perspective.” On the one hand, it will look at the effect of trust in authorities on citizens' perceptions and uses of these tools. On the other hand, it will explore the effect of using these tools on citizens' trust in authorities, and the different trust-building dynamics entailed in these processes. Understanding both trust in authorities and technology use as cultural factors, it will also compare and contrast the potential of disaster apps and social media to help in building, re-building, or strengthening trust relationships between citizens and disaster management authorities.

2 | “DISASTER APPS” AND TRUST IN AUTHORITIES

Information is key during every stage of the disaster cycle, and it was declared a basic need by the International Federation of Red Cross and Red Crescent Societies (IFRC), stating that “people need information as much as water, food, medicine or shelter” (IFRC, 2005). In the process of fulfilling this need, trust, or distrust, will not only impact what source of information will be sought (The Heritage Foundation, 2012), but also whether or not a specific tool for information-seeking is adopted at all (Tagliacozzo & Magni, 2016). For the purpose of this study, trust, with a specific focus on trust in authorities, is understood as a cultural factor, which comprises multiple dimensions (trusting behaviour, trusting intentions, willingness to trust) and may relate to, for example, perceptions of competence, honesty, credibility, or shared value systems (PytlikZillig & Kimbrough, 2016).

In this context, research has revealed several factors that strongly influence citizens' trust in disaster management authorities: these authorities' perceived capability to provide effective disaster relief, the credibility of disaster managers as experts rather than government officials with a political agenda, and perceived or experienced levels of corruption within these authorities (Eisner, Donovan, & Sparks, 2015; Kääriäinen, 2007; Kaigo, 2012; McLean & Ewart, 2015).

Other factors that have been found to affect citizens' trust in authorities are, in particular, perceptions of discrimination towards minority groups (Van Craen & Skogan, 2015; Wray & Jupka, 2004), and “place-sharing,” that is, local emergency responders being perceived as more trustworthy than governmental sources, because local authorities are seen by members of local communities to be “watching the same thing” (Wray, Rivers, Whitworth, Jupka, & Clements, 2006). Additionally, those who are actually, or imagined, to be place-sharing may be perceived as also sharing the same values which, in turn, fosters impersonal trust relationships⁵ at times of uncertainty and time pressure. Although impersonal trust may, initially, be short-term and specific to the respective disaster situation in which it emerged, through sustained communication via social media and the development of a shared (online) history it also holds the potential to underwrite personal trust (Mehta et al., 2017).

It is important to outline that this trust-building is based on a process of “sharing.” In communications between citizens via social media, not only information but also emotions are shared (e.g., Rodriguez Hidalgo, Tan, & Verlegh, 2015), which contribute to the development of shared narratives and, hence, collective identity. Further, trust relationships are developed through strong bi-directional communications that lead to gradual reduction in tension between citizens and authorities (Busà, Musacchio, Finan, & Fennel, 2015), though there is little research into whether such functions may also be ascribed to mobile phone apps that are specifically designed for disaster communication. For example, when studying the effectiveness of mobile text alerts in emergency situations,⁶ Wong and colleagues found that text messages sent out by a trusted source were seen by participating citizens to be not enough but need to be embedded in a system that allows

bi-directional communication (Wong, Jones, & Rubin, 2018). This finding confirmed earlier research conducted on citizens' perceptions of Wireless Emergency Alerts (WEA),⁷ where participants appreciated that in case of an emergency short messaging may be required, but they also felt frustration—or even uncertainty or fear—due to a lack of background information and the lack of an interactive option for validation or clarification (Bean et al., 2016), which can undermine or, at least, fail to support or create trust.

Whilst these studies only relate to one of the various potential functionalities of any “disaster app,” it may be questioned whether such apps substitute or are complementary to social media platforms, and what specific roles and functions they can successfully take up. As laid out previously, there are numerous studies on how different social media have been used by citizens in emergency situations, but there are very few studies, which compare and contrast citizens' attitudes towards, and perceptions of, their use, or intended use, of the various tools, and even fewer that combine quantitative and qualitative methods.

One recent exception is the survey by Reuter and Spielhofer (2017) conducted amongst 1,034 citizens across Europe, which revealed that 43% of participants were already using social media for emergency-related information-gathering, but only 27% were using them for information-sharing. Slightly fewer, that is, 22%, indicated that they were using specific mobile phone apps for sharing or receiving such information. Interestingly though, the picture changed when being asked for their intended future use. In this case, 58% of participants indicated that they intended to use social media for information-gathering, but less (48%) for information-sharing. At the same time, the proportion of participants with intentions to use mobile phone apps for sharing or receiving information rose from 22% to 60%. However, there is little information about the respondents' specific motivation (or lack thereof) for using apps instead, or in addition to, social media, beyond a lack of awareness of such apps (Reuter & Spielhofer, 2017).

These results highlight the potential of specifically designed mobile phone apps in disaster communication. However, creating, publishing, publicizing, and maintaining an app can be more time-consuming than managing a mobile website, and the app development alone is an expensive process with technical challenges, such as the building of animations that realistically illustrate complex scenarios for information or training of disaster preparedness without compromising the ease of understanding (Winami & Purawandari, 2018). Therefore, more detailed research is needed into citizens attitudes and perceptions to help disaster managers, who have to take such costly decisions, aiming to develop disaster apps that are trusted and that do not share the fate of about one out of four downloaded apps worldwide, which are immediately deleted after their first use,⁸ because they do not meet the users' needs.

3 | METHODOLOGY

Empirical data for this study were collected during two Citizen Summits organized as part of the CARISMAND⁹ project and held in

Questionnaire	
Q1	<p>(a) Have you, or a close friend or family member, ever experienced a disaster?</p> <p>(b) Do you feel you are living in an area that is specifically prone to disasters?</p> <p>(c) Do you know of any other people in your area where you live who, you think, are particularly vulnerable or exposed to disaster?</p> <p>(Answer options: Yes / No / I'm not sure)</p>
Q2	<p>When you think of [respective authority: Civil Protection; local police; medical emergency services; fire brigade; voluntary aid institution, the media], how trustworthy do you think they are?</p> <p>(5-point Likert scale: 1 = not trustworthy at all; 5 = very trustworthy)</p>
Q3	<p>When you think of [respective authority: Civil Protection; local police; medical emergency services; fire brigade; voluntary aid institution, the media], how effective in providing help do you think they are in case of a disaster?</p> <p>(5-point Likert scale: 1 = not effective at all; 5 = very effective)</p>
Q4	<p>How much do you believe that the local authorities/emergency services trust YOU, as a citizen that you are appropriately prepared for a disaster?</p> <p>(5-point Likert scale: 1 = they distrust citizens a lot; 5 = they trust citizens a lot)</p>
Q5	<p>How much do you believe that the local authorities/emergency services trust YOU, as a citizen that you are able to respond appropriately in a disaster situation?</p> <p>(5-point Likert scale: 1 = they distrust citizens a lot; 5 = they trust citizens a lot)</p>
Q6	<p>In the case of a disaster, how likely are you to use social media to</p> <p>(a) inform yourself about the disaster?</p> <p>(b) submit information about disaster risks or disasters to local authorities / emergency services?</p> <p>(c) warn/inform other social media users?</p> <p>(5-point Likert scale: 1 = very unlikely; 5 = very likely)</p>
Q7	<p>In the case of a disaster, how likely are you to use a mobile phone app that is specifically made for disaster situations to</p> <p>(a) receive alerts, warnings or emergency-related information from local authorities / emergency services?</p> <p>(b) submit information about disaster risks or disasters to local authorities / emergency services?</p> <p>(c) warn/inform other app users?</p> <p>(5-point Likert scale: 1 = very unlikely; 5 = very likely)</p>
Q8	<p>Imagine there is a high risk that a disaster will occur in the area where you live. If you use social media, how much would you trust, or mistrust, messages from</p> <p>(a) local authorities?</p> <p>(b) private users of social media?</p> <p>(5-point Likert scale: 1 = not trust at all; 5 = trust a lot)</p>
<p>Notes:</p> <ol style="list-style-type: none"> Findings presented in this article represent only one of several research topics targeted in these Citizen Summits. Questions related to other topics (in particular, more in-depth data collection on risk perception and disaster preparedness) are not included in the questionnaire above. Qualitative questions in the focus group discussions followed up on the same content as these quantitative questions, but were phrased as open-ended questions to let the participants speak freely and encourage them to develop their own ideas. 	

FIGURE 1 Questionnaire

TABLE 1 Perceived effectiveness and trustworthiness of different authorities in disaster situations

	Perceived trustworthiness				Perceived effectiveness			
	Italy		Germany		Italy		Germany	
	Mean	STD	Mean	STD	Mean	STD	Mean	STD
Civil protection	3.89	0.860	3.97	0.783	3.98	0.978	3.93	0.854
Local police	2.57	1.002	3.34*	1.040	2.41	1.031	3.02*	1.124
Medical emergency services	3.82	0.829	3.94*	0.892	3.89	0.819	3.81	0.972
Fire brigade	4.57	0.637	4.21*	0.736	4.59	0.617	4.23*	0.723
Voluntary aid institutions	3.62	0.879	3.77	0.903	3.84	0.859	3.60	0.816
The media	3.00	0.885	3.03	1.150	3.27	1.057	3.30*	1.096

Note: Trustworthiness: 5-point Likert scale: 1 = not trustworthy at all; 5 = very trustworthy.

Effectiveness: 5-point Likert scale: 1 = not effective at all; 5 = very effective.

*Results between countries are significantly different ($p < .05$).

Rome (Italy) and Frankfurt (Germany) in June 2017. These two research sites were chosen because both Italy and Germany are positioned in the middle ranks of disaster risk indices amongst European countries,¹⁰ but with very specific local experiences. On the one hand, citizens in the Rome area are living in a comparatively safe location but, at the time of the summit, had very recent experience of a series of earthquakes ("natural hazards"). On the other hand, citizens living in the Frankfurt/Rhine-Main area may not have had recent experiences but are exposed to an elevated level of local "man-made hazards" (large airport, chemical industry).

Citizen Summits are events which were, originally, organized by public authorities to allow "ordinary" citizens, rather than experts, to express their attitudes and opinions about issues of public interest. For example, one of the very first Citizen Summits was organized in 1999 by the City Council of Washington, DC, where citizens were invited to discuss the Council's quality of community services. This event combined plenary sessions, where the participants were given electronic keypads to provide immediate feedback, with small discussion groups led by trained moderators (Callahan, 2006). Since then, this event format has been employed by a wide range of governmental and non-governmental institutions to gather insight into citizens' opinions about a variety of different topics, ranging from the future of Europe and climate change to gender issues. More recently, it has also been used for scientific research, for example, related to citizens' perceptions and attitudes towards surveillance technologies (Degli Esposti & Santiago Gomez, 2015).

Following the same concept, CARISMAND Citizen Summits combined public information and public feedback-gathering with quantitative and qualitative data collection. The Italy Citizen Summit was held in Rome, with participants recruited from the greater Rome and Lazio region.¹¹ The Germany Citizen Summit was held in a conference centre at the Frankfurt International Airport with participants from all over the Rhine-Main area.¹² Participants were recruited via local research agencies using an industry-standard "FreeFind" approach,¹³ and they were incentivized in line with regular local practices. A recruitment questionnaire ensured the selection of balanced

samples with an even gender and age distribution, and 105 participants in each of the two locations. Furthermore, the recruitment criteria included key aspects of disaster experience and disaster risk perception (Q1 in Figure 1 below), to ensure that all levels of experience with disasters were present in each sample. Quantitative data were collected via a plenary session in the morning, capturing participants' immediate responses to all questions via an audience response system.¹⁴ After each Summit, these responses were exported to a database and fully anonymized. All analyses were conducted with SPSS version 24.0, and significance tests were run for all results. For the qualitative part of the study held in the afternoon session of each event, participants were allocated to ten simultaneously held discussion groups of nine to eleven participants with an even gender split, and a division into age groups that aimed to allow participants to discuss amongst peers with similar life experience. Focus group discussions were conducted in Italian and German, respectively, in order to avoid any language or education-related access restrictions for participation. All discussions were audio-recorded, fully transcribed, and the transcripts were translated into English. To ensure the anonymity of participants, all names and other personal identifiers were removed in this process. The line-by-line coding of the translated transcripts followed a preliminary coding framework, which had been set up to allow an initial structuring of the collected data. This initial coding framework was based upon general themes defined in the focus group discussion guideline. The results of this first coding permitted the development of a more refined matrix—an "analytical scaffolding" (Charmaz, 2006)—in the next step. After recoding the transcripts of all 20 discussion groups based on this matrix, new themes were identified, which provided a better focus on specific processes and practices or constructions and interpretations. In a final step, the qualitative results were compared to the quantitative results in order to provide a balanced picture, add depth, and increase the validity of findings.

Research questions targeted several sub-topics, which built upon each other: in a first step, a set of questions sought to explore citizens' expectations of, and trust in, different authorities

and institutions, complementing previous research, and provide the foundation for subsequent questions (Q2, Q3). The investigation of trust in a number of institutions that may play a role in different phases of disasters was intended to shed light on potential differences in, but also relationships between, trust relationships. Additionally, this set explored trust with a specific focus on its understanding as a bi-directional relationship between citizens and disaster managers (Q4, Q5). A second set of questions specifically targeted citizens' intended use of social media and mobile phone apps, differentiating between these tools as well as between different categories of communications with a specific focus on trust (Q6–Q8). This structure was followed in both the quantitative and the qualitative part of the research.

4 | RESULTS

4.1 | Trust as culture

Quantitative results revealed that in both research locations citizens' relative trust in, and perceived effectiveness of, the different institutions involved in disaster management was very similar (see Table 1 below). The fire brigade, civil protection, and medical emergency services were deemed most trustworthy, whereas most participants perceived the media¹⁵ and the local police as untrustworthy. An almost identical picture was revealed for the perceived effectiveness of these institutions in case of a disaster, but for German participants showing significantly more trust in their local police and perceiving them as more effective than their Italian counterparts.

Results from the focus group discussions suggest that the generally low levels of trust in the media in this context were mostly influenced by sensationalist reporting during crises. At the same time, though, participants in both Italy and Germany outlined that positive media coverage of emergency services response in disasters serve to build trust. Participants felt that “success stories”—“when the rescuers fly with their dogs to the most remote corners and always find at least one survivor”—sell well in the media and can be a source of trust in the emergency response services through (national) pride, in particular when the rescue forces were deployed abroad.

Furthermore, results from the focus group discussions in both locations indicate that the low levels of trust in the local police, as reported in the quantitative part of the study, are influenced by perceiving the local police as more interested in keeping order (e.g., relating to traffic and parking offences) than to helping citizens: “I do

not trust the police because they have more administrative roles, they are more trained to fine people than to deal with real emergencies.” However, some participants elaborated that, despite their distrust of the police, they perceived trust in authorities as a form of civic duty. Interestingly, several Italian participants distinguished between mistrust of the local police as the prevalent feeling and trust as normative behaviour, and they described their difficulties in reconciling these two positions: “There is a sort of social contract. Authorities are authorities, and we need to trust them, otherwise if they tell me to do something I will not do it [...] However, when you asked the question I thought we cannot trust the police too much. Even though I try to.”

This is consistent with a previous finding from the first CARISMAND Citizen Summit held in 2016 in Bucharest, Romania.¹⁶ In that summit, Romanian focus group participants had expressed their distrust in the authorities dealing with disasters, relating it to a perceived lack of effectiveness in disaster response. However, there participants simultaneously rationalized that such an attitude may be counter-productive, because “the authorities can't help if you don't trust them.” This may be interpreted as mistrust arising from personal experience and expectation being at odds with trusting behaviour, which is embedded in the acceptance of hierarchical structures as a cultural norm, creating ambivalent feelings about the relationships between citizens and authorities in disaster situations.

An additional cultural aspect was brought up during the focus group discussions in the German Citizen Summit, where several participants with a migration background from South-Eastern Europe and Russia described that they trusted the authorities in Germany more because “here in Germany we can trust the emergency services [...] you don't have as much corruption [...] I do feel in good hands here.” Yet, another type of trust relationship between citizens and authorities emerged from German participants who grew up in Israel or lived there for an extended period: “In Israel, there is a much stronger feeling of closeness to the police force, they are a part of the population. Here, in Germany, there is a clear dividing line between citizens and the police. It was a very different feeling in Israel [...] you grow up with security guards from a very early age. They don't cause fear, they are there for you. In Germany it's very different.” These findings suggest that it cannot be assumed that groups of the population with a non-native background (e.g., migrants, expatriates) will in all cases distrust authorities in a disaster situation. On the one hand, this may be the case for those recent migrants who still have very “fresh” experiences of rejection, corruption, and/or

Beliefs that local authorities/emergency services trust citizens that they are....	Italy		Germany	
	Mean	STD	Mean	STD
...appropriately prepared in case of a disaster	2.61	0.870	2.99*	1.181
...able to respond appropriately in a disaster situation	2.57	0.877	2.58	1.065

TABLE 2 Citizens' beliefs about authorities trusting/distrusting citizens

Note: 5-point Likert scale: 1 = authorities distrust citizens a lot; 5 = authorities trust citizens a lot.

*Results between countries are significantly different ($p < .05$).

are coming from war-torn countries. On the other hand, migrants or expatriates who have settled and strongly identify themselves with their new home and the new environment may be of particular help, not only because of their cultural knowledge and language skills but also through their increased level of trust in authorities. They may be able to assist the authorities as informal liaison persons, or online facilitators, who can mediate between affected minority groups and disaster managers.

The quantitative data revealed generally strong relationships¹⁷ between trust in an institution and the perceived effectiveness of that institution. For example, if participants perceived the effectiveness of the fire brigade to be high, they would also indicate a high level of trust in the fire brigade. Likewise, a lower level of perceived effectiveness of the local police was strongly related to a lower level of trust in the local police. This finding applies to both Italy and Germany, and the qualitative data showed that participants frequently drew a connection between speed of response (and thus effectiveness) and trust: "They all come with sirens and an entire team, and you see that help 'comes running'. And I believe that builds a lot of trust."

However, there are some country-specific differences in the extent to which trust in one institution involved in disaster management is translated into trust in or perceived effectiveness of the other institutions involved in disaster management. In Germany, for most institutions it was the case that trusting one disaster management institution, or perceiving it as effective, was only weakly related to trusting other disaster management institutions or perceiving them as effective. An exception was the medical emergency services; participants who trusted the medical emergency services and perceived them as effective were generally more likely to also have the same views of the other disaster management institutions. These correlations were mostly above $r = .4$; the strongest correlations in this context were found between trust in medical emergency services and trust in civil protection ($r = .648$).

Some of the findings from the qualitative part of the study addressed the same issue. There, most of the participants reported that they had had personal experiences with medical emergency services; the experiences of these services in responding to smaller-scale incidents influenced citizens' perceptions and feelings towards other authorities in disaster management. At the same time, the comparatively lower perceived effectiveness of and trust in local police forces is also likely to be shaped by the participants' everyday

experiences, but these experiences appeared *not* to affect participants' perceptions and feelings towards other authorities in the quantitative part of the study.

These findings were also supported by the qualitative data; German participants explicitly made a connection between perceived effectiveness and general feelings of trust whilst, at the same time, they rejected drawing a connecting line between perceived lack of effectiveness and general feelings of distrust. These results suggest that perceived effectiveness and trust in one service dealing with disaster management based on everyday experiences generalize to other services in the same sector. But perceived lack of effectiveness and mistrust arising out of similar experiences do *not* generalize in the same way.

Furthermore, on average participants believed that they were not trusted by the authorities/emergency services to be prepared for, and act appropriately in case of, disasters (see Table 2). However, no significant correlations could be found between these results and participants' responses regarding *their* trust in the different authorities.

4.2 | Technology use as culture

Trust, or distrust, also plays an important role in citizens' uptake and use of social media and mobile phone apps for disaster preparedness, response, and recovery. The quantitative results (see Tables 3 and 4 below) showed that a large proportion of participants indicated they were likely or very likely to use both disaster apps and social media in disaster situations, and in the focus group discussions they explained that they perceived it as their civic duty to use the tools available: "We need to take advantage of new possible ways of communication [...] It's our responsibility, we need to use these things." In both locations, social media were most likely to be used to inform oneself about a disaster, followed by warning or informing other social media users. The likelihood of using social media to submit information about disaster risks or disasters to local authorities or emergency services was lower than the likelihood of using social media to inform oneself or warn others, but still ranged between 57% of participants in Italy and 41% in Germany who indicated that they were likely or very likely to do so. An Italian participant explained during the focus group discussions: "I find the interaction with the institutions very interesting. They usually reply to me. This increases trust towards the institutions I'm talking to."

These results suggested that the development of social media applications in disaster management should target multi-functional solutions, which allow different information flows.

However, the picture, which emerged regarding disaster apps, made an even stronger case for their potential use in disaster situations. In the Germany Summit, the likelihood of using such mobile phone apps to receive warnings, alerts, or emergency/disaster-related information was highest, followed by the likelihood to warn or inform other app users. As was the case for social media, the likelihood of using mobile phone apps to submit disaster-related information to authorities was lowest, but still for all three purposes the

TABLE 3 Likelihood of citizens' social media use in disaster situations

	To inform oneself		To submit information to authorities		To warn/inform other social media users	
	Mean	STD	Mean	STD	Mean	STD
Italy	4.13	1.005	3.46	1.140	3.79	1.035
Germany	3.72	1.358	2.92	1.463	3.61	1.246

Note: 5-point Likert scale: 1 = very unlikely; 5 = very likely.

likelihood of apps usage was generally higher than the likelihood of social media usage, in particular for submitting information to authorities. In Italy, the data show an almost identically high level of likelihood for all three purposes of mobile app usage, between 77% indicating they were likely or very likely to use such apps to warn or inform other app users, and 71% indicating they were likely or very likely to use apps for submitting disaster-related information to local authorities or emergency services. This suggests that implementing mobile phone apps for crowd sourcing or crowd tasking in disaster management may hold a higher potential for authorities to actually receive information from citizens than using social media for that purpose. Some of the participants explained that, by using a disaster app, "you can actively be of some help," others also expressed their feeling of being taken more seriously by the authorities when submitting information via a designated app, rather than via a social

media site: "When sending something through Facebook or some other social media, my request may not be taken into consideration; on the contrary, I would be more likely to provide information via an app."

In this context, the focus group discussions revealed several desired features of such disaster app. Most prominently, participants in both Italy and Germany felt that it should be authored and led by a public authority, for example, Civil Protection, or a supra-national entity or NGO at EU level. Participants also reaffirmed their expectations that disaster or emergency apps should allow authority-to-citizen, citizen-to-authority, and citizen-to-citizen communication, and include functions for both disaster response and disaster preparedness. Another prominent aspect was the expectation of most participants that such an app should be automatically pre-installed when purchasing a new phone, which highlights the important role that participants assign to it also in their everyday lives.

Furthermore, the quantitative data showed a number of interesting relationships between usage of mobile phone apps and social media in disaster-related communications (see Tables 5 and 6 below). Firstly, participants who indicated that they were likely to use one function of a disaster app (e.g., to receive alerts) were also likely to use the other functions (submit information to authorities, warn other app users), which reconfirms the importance of multi-functional solutions. Amongst the suggested use of social media in disaster communications, these correlations are

TABLE 4 Likelihood of use of citizens' mobile phone apps in disaster situations

	To receive alerts/information		To submit information to authorities		To warn/inform other app users	
	Mean	STD	Mean	STD	Mean	STD
Italy	3.89	1.179	3.82	1.034	3.99	0.980
Germany	4.00	1.192	3.40	1.405	3.72	1.305

Note: 5-point Likert scale: 1 = very unlikely; 5 = very likely.

TABLE 5 Citizen summit Italy: mobile phone apps and social media use in disasters pearson's correlations

	Apps: receive information	Apps: inform authorities	Apps: inform other users	Social media: receive information	Social media: inform authorities
Apps: inform authorities	0.710*				
Apps: inform others	0.611*	0.614*			
Social media: receive information	-0.025	0.100	0.037		
Social media: inform authorities	0.133	0.191	0.161	0.360*	
Social media: inform other users	-0.004	0.074	0.228	0.502*	0.517*

Note: *Correlations in this table marked with an asterisk are statistically significant at $p < .001$.

TABLE 6 Citizen summit Germany: mobile phone apps and social media use in disasters pearson's correlations

	Apps: receive information	Apps: inform authorities	Apps: inform other users	Social media: receive information	Social media: inform authorities
Apps: inform authorities	0.574*				
Apps: inform others	0.522*	0.668*			
Social media: receive information	-0.181	0.288*	0.349*		
Social media: inform authorities	0.319*	0.636*	0.486*	0.511*	
Social media: inform other users	0.066	0.345*	0.491*	0.651*	0.562*

Note: *Correlations in this table marked with an asterisk are statistically significant with $p < .001$.

TABLE 7 Citizens' trust and distrust in different social media sources in a disaster situation

	Italy		Germany	
	Mean	STD	Mean	STD
Trust in local authorities	3.76	0.812	3.58	0.945
Trust in private users	2.95	0.908	2.87	0.853

Note: 5-point Likert scale: 1 = not trust at all; 5 = trust a lot.

also visible but not as strong.¹⁸ Here, the largest difference between mobile phone apps and social media can be found for the relationship between usage for receiving information and usage to inform authorities: whereas this relationship for apps usage is rather strong ($r = .710$), the same relationship for social media usage is much weaker ($r = .360$). This suggests that apps, much more than social media, are perceived as a bi-directional means of communication between citizens and authorities which, as in particular Italian participants felt, “makes you keep things under control,” increases your control,” and draws upon “a personal responsibility to use these things [apps].” German participants expressed the opinion that “disaster management should be more accessible to the people who are impacted,” and that a disaster app, which they perceived to be “also about communication and responsibility to manage [disaster communication],” would provide such an opportunity.

Another interesting finding in this context is the correlation between mobile phone app use to submit information to authorities in disaster situations and social media use for the same purpose, which is a relationship that was not found at the same level of strength across apps and social media use for the other two functions. This link was strong in Germany ($r = .636$), but very weak in Italy ($r = .191$), which may be interpreted as a specific usage that is strongly motivated by these German citizens' general interests in cooperating with authorities rather than being bound to a specific type of technology. At the same time, the German data also revealed weak correlations between “passive” use of mobile phone apps (i.e., use for receiving information) and any of the three types of social media use, whereas for “active networkers” (i.e., those who would warn or inform other users) a medium correlation between mobile phone apps and social media usage was found. Given the aforementioned high overall likelihood of both German and Italian participants' intended mobile phone apps use in disaster situations, the reverse conclusion may be drawn that citizens who are not active or frequent social media users may still be very interested in using mobile phone apps designed for disaster preparedness. In this context, some of the younger participants explained their preference for disasters apps based on data security issues – “I trust apps more than social media; social media can be abused.” Middle-aged participants particularly appreciated that “it does not cost you any time [...] but people still have the feeling that they are participating [...] you can integrate it in your daily life.” Some of the older participants explained their preference for apps via their greater familiarity with mobile phones: “I

have a mobile phone which is new, but I don't use apps. But with this option I would start to do so, because I think it's very useful.”

Generally, the older participants in Italy as well as in Germany held a somewhat critical attitude towards social media: “I think I would trust the authorities, [...] but I don't think I would trust Facebook.” Yet, these older participants showed the most positive response across all age groups¹⁹ towards using a disaster and emergency app, contradicting the cultural stereotype of older people being generally more technology-averse: “When I grew up there weren't even mobile phones around. We survived without them, but we may as well use as much technology as we can now.” Additionally, participants in all age groups felt that such apps would not only contribute to community-building amongst citizens—a function that was more often ascribed to social media—but they were imagined as contributing to the development of a specific “culture of preparedness,” based on the common interest in new technology use.

Furthermore, the qualitative data revealed that social media were often equalled with Facebook and, exclusively, with social media messages from private individuals. Many participants in both locations were unaware of public authorities' profiles on social media. Those German participants who had known or used such sites before trusted these sites considerably more than social media messages from private media channels or other individual social media users: “If the police publish something like this I will trust it because they will have investigated it”; “I would say the local police are very trustworthy when they offer information on social media”; “the police, [...] of course, they are also learning [how to use social media], but I think we should really start to believe them and trust them.” This finding was strengthened by both the Italian and German data, which revealed a considerable difference between the respective information source. Whereas between 64% (Italy) and 58% (Germany) of the participants indicated that they trust (or trust a lot) messages from local authorities (and only 5% in Italy and 13% in Germany distrust or distrust a lot), only about one out of five participants in either summit answered that they trust (or trust a lot) messages from other private social media users (Table 7).

Consequently, this may be interpreted as these participants' trust being based not on their perceptions of the physical disaster response by police forces, but on the police's perceived ability to provide trustworthy and timely information. It also points at the potential of social media to rebuild citizens' trust in the police by taking up this role of a trustworthy local information provider at times where the large private and public media channels are increasingly distrusted: “I'd rather believe the smaller outlets, like the local police who is posting something for their neighbourhood.”

5 | DISCUSSION

Trust helps to reduce complexity and motivate people to act in times of uncertainty (Mehta et al., 2017). Therefore, the focus of this study was not only on which trust relationships between citizens

and authorities are most favourable for the uptake of social media or mobile phone apps, but also how the use of social media or mobile phone apps may contribute to building, or re-building trust. At the same time, trust-building in specific media, authorities, and technologies can be seen as a process that tends to reinforce itself, that is, when a specific tool due to its availability becomes the dominant source of information for a person's needs, it is more likely to become trusted and influential (Spence et al., 2015). Accordingly, the growth and success of social media use in disasters is likely to be the result of these intertwined dynamics, and a similar development can possibly be expected for disaster apps that are well-designed, well-publicized, and well-maintained. However, rather than understanding these tools as either interchangeable or mere steps in technological progress from one (social media) to the other (apps), our findings point at distinct functions and perceptions, which are only partially overlapping.

Social media use involves the sharing of both information and emotions, allowing people to feel part of a "like-minded community" and generating trust through developing shared narratives. This can be seen as one of the specific strengths of social media in disaster communication, and previous studies have shown that it constitutes a ritual function, which provides emotional relief through collective sense-making (e.g., Jung & Moro, 2014; Neubaum et al., 2014). Additionally, it can enable disaster victims to maintain a sense of "home," at least virtually (Hughes et al., 2008). Building upon these previous studies, we found that participants were particularly interested in social media communication with *local* authorities, which represents an opportunity for these authorities to build or improve *local* trust relationships based on a place-sharing that is both physical and virtual.

In disaster apps usage, our findings suggest that trust between citizens and authorities is generated through perceptions of taking up responsibility, rather than through sharing narratives as found, for example, by Mehta et al. (2017). Accordingly, such apps may be seen not only as an opportunity for citizens to gain a feeling of control in situations of uncertainty (e.g., Spence et al., 2015), but as mechanisms that reveal authorities' general willingness to share control. Therefore, the implementation and use of disaster apps may help overcome citizens' perceptions that they are distrusted by authorities. At the same time, disaster apps appear to hold a greater potential to be accepted by older citizens. These citizens are more interested in appropriate disaster preparedness and a trusted, but functional, citizen-authority communication in disaster situations, than in the community-building role of social media.

To summarize, both social media and disaster apps hold the potential to not only be useful tools in disaster communication between citizens and authorities based on existing trust, but they also have the ability to help in building, re-building, or strengthening trusted relationships. Also, both social media and apps may allow members of minority groups, for example, migrants or expatriates who have settled and strongly identify themselves with their new home, to contribute to these dynamics through a combination of

cross-cultural knowledge, language skills, and their increased levels of trust in authorities.

However, apps more than social media were perceived as reliable bi-directional means of communication between citizens and authorities. Despite their trust in authorities per se, several participants distrusted social media as a medium due to privacy and data protection issues. On the other hand, social media may foster in particular trust relationships between citizens and local authorities by using the sharing of locality as a basis in combination with taking up the function of a trusted information provider. As such, its function can go beyond the mere developing of shared narratives and sense-making, but may take advantage of citizens' different perceptions of local authorities "offline" (imposing regulation) and online (providing a service). Whereas these differences may also apply to apps, power relations between citizens and authorities in apps usage appeared to be perceived as more "balanced" and aiming at "partnership" rather than "community."

6 | CONCLUSION

Improving citizens' trust in authorities via mobile phone apps that are perceived as tools in a functional partnership of sharing tasks on the one hand, and building local trust relationships between citizens and authorities via social media through shared narratives and sense-making community on the other hand are processes that can be seen as equally important in society. Ideally, apps and social media should complement rather than substitute each other in disaster-related communication. However, despite ever-increasing numbers of well-managed social media websites of local police forces and multi-functional disaster apps with regional or national reach, the changing reality of these technologies does not stop here: Trust may be situational, but it is also a cultural factor and, as such, subject to constant change in societies. Disaster apps allow and foster behaviours that can become the basis for new understandings, rituals, values, and norms. Thus, new designs of such apps provide a unique opportunity to integrate citizen science not only through crowdsourcing or crowdtasking but also by tracking trust levels as cultural change in real-time.

7 | LIMITATIONS

The main limitation of this study lies in that the data in both research locations were collected from non-probability samples, which are not representative of either the German or the Italian population. Furthermore, data were collected in two geographical locations only. However, the samples had a spread of participants of all ages, an even gender split, and different levels of disaster experience and disaster risk perception. In addition, these locations were chosen due to their difference in local disaster histories and types of local hazards, and the similarity of participants' responses in both Citizen Summits suggests that citizens' contrasting attitudes and perceptions towards disaster apps and social media use in disasters may not

be significantly affected by local differences in disaster experiences and disaster risk perceptions.

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ENDNOTES

- ¹ The technology works by detecting aircraft using remote sensors on the ground and machine-learning algorithms, which look at the speed of an aircraft and its usual flight pattern. It then sends alerts via messaging apps and Facebook, as well as setting off air raid sirens in the areas likely to be affected. Since the system was launched, it has been estimated to have reduced casualties by up to 27% in areas under heavy bombardment (<https://halasystems.com/>; accessed 11/2018).
- ² <https://www.statista.com/statistics/380542/number-of-mobile-facebook-users-worldwide/>; <https://www.statista.com/statistics/274565/monthly-active-international-twitter-users/>; accessed 11/2018.
- ³ For an app with comprehensive functionalities see, for example, the *Disaster Preparedness Tokyo* app; https://play.google.com/store/apps/details?hl=en_GB&id=jp.tokyo.metro.tokyotobousaiapp accessed 11/2018.
- ⁴ Tan et al. (2017) identified 115 articles focusing on social media in disaster communication, but only 49 articles that discussed the specific use of mobile phone apps in disaster situations. Further, they found that most of the reviewed articles presented theoretical or model app systems.
- ⁵ Impersonal trust describes a trust relationship which is not based on inter-personal relations, such as that between people and institutions (e.g., Shapiro, 1987).
- ⁶ Although mobile text alerts are not the same as mobile phone apps, such notifications can be seen as representative of one of the multiple functions of a mobile phone app.
- ⁷ WEA is a SMS-like public warning system in the USA using Cell Broadcast for delivering messages to all mobile phone users. The European equivalent is EU-Alert. As with mobile text alerts, these research findings, whilst not relating directly to “disaster apps,” suggest probable citizens’ attitudes towards a notification function in mobile phone apps.
- ⁸ <https://www.mobileappdaily.com/2018/07/28/app-download-statistics-usage-facts/>; accessed 12/2018.
- ⁹ CARISMAND (Culture And RISK management in Man-made And Natural Disasters) is a research project co-funded by the European Commission under the Horizon 2020 Programme (2014–2020), which aimed to explore the relationships between disaster risk perception, culture and (disaster-related) behaviour. As part of this project, six Citizen Summits and three Stakeholder Assemblies in different countries (Romania, Malta, Italy, Germany, Portugal, and the Netherlands) were organized over the course of three years. All Citizen summits addressed the same overarching research theme, that is, risk perception and culture in disaster management, and each of the three individual “rounds” of summits explored a

specific set of additional topics. Findings presented in this article represent only one of several research topics targeted in these summits.

- ¹⁰ <https://reliefweb.int/report/world/world-risk-report-2017>; accessed 08/2018.
- ¹¹ One of Italy's 20 administrative regions with Rome being its regional capital.
- ¹² Metropolitan region in Germany stretching over several large cities.
- ¹³ Process of recruiting participants outside existing databases or panels, using any, or a variety of, suitable methods (e.g., posters, newsletters, social media).
- ¹⁴ Klik-a-pad system with ppvote software; <http://www.klikapad.com>.
- ¹⁵ At this initial level, the question targeted attitudes and perceptions towards the media in general, understood as an entity involved in disaster communication.
- ¹⁶ Although the topic of trust in authorities was not specifically targeted in the previous “round” of CARISMAND Citizen Summits in 2016, held in Bucharest (Romania) and Malta, it was brought up by Romanian participants during the focus group discussions in the context of behavioural intentions in disaster situations.
- ¹⁷ Between $r = 0.837$ for the fire brigade (Italy) and $r = 0.617$ for the media (Germany); only for Civil Protection it is slightly lower but still $r = 0.533$ (Germany).
- ¹⁸ With the exception of the correlation between receiving information via social media and warning/informing other social media users in the Germany data ($r = 0.651$).
- ¹⁹ Although the majority of participants in all discussion groups supported the use of specifically designed disaster and emergency app, only in those groups with participants aged 45+ all provided a positive response.

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